

(NASA-TT-F-14967) REPORT OF STUDY ON
VEGETATION, SOIL AND LAND USE AT KEY
SITES (Scientific Translation Service)

N73-26393

#7 p HC \$3.00

CSCI 08M

Unclass

G3/13 08713

REPORT OF STUDY ON VEGETATION, SOIL, AND
LAND USE AT KEY SITES

B. V. Vinogradov



Translation of: "Otchet po Programme SSSR
po Izucheniyu Rastitel'nosti, Pochvy i
Ispol'zovaniya zemel' na Klyuchevykh Uchast-
kakh", Institute of Space Research, Academy
of Sciences USSR, Report presented to the
Meeting of Soviet-American Working Group on
Remote Sensing of Natural Environment from
Space, Moscow, Feb. 12-17, 1973, 4pp

1. Report No. NASA TT F-14,967		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle REPORT OF STUDY ON VEGETATION, SOIL, AND LAND USE AT KEY SITES				5. Report Date June 1973	
7. Author(s) B. V. Vinogradov				6. Performing Organization Code	
9. Performing Organization Name and Address SCITRAN P.O. Box 5456 Santa Barbara, CA 93108				8. Performing Organization Report No.	
				10. Work Unit No.	
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Washington, D.C. 20546				11. Contract or Grant No. NASw - 2483	
				13. Type of Report and Period Covered Translation	
14. Sponsoring Agency Code					
15. Supplementary Notes Translation of: "Otchet po Programme SSSR po Izucheniyu Rastitel'nosti, Pochvy i Ispol'zovaniya zemel' na Klyuchevykh Uchastkakh", Institute of Space Research, Academy of Sciences USSR, Report presented to the Meeting of Soviet-American Working Group on Remote Sensing of Natural Environment from Space, Moscow, Feb. 12-17, 1973, 4 pp.					
16. Abstract A description is given of remote sensing methods to study the vegetation, soil, and agricultural use of the land. Photographs obtained by Soyuz-9, Salyut, and Meteor spacecraft are analyzed for this purpose.					
17. Key Words (Selected by Author(s))				18. Distribution Statement Unclassified - Unlimited	
19. Security Classif. (of this report) Unclassified		20. Security Classif. (of this page) Unclassified		21. No. of Pages 6	
				22. Price 3.00	

REPORT OF STUDY ON VEGETATION, SOIL, AND
LAND USE AT KEY SITES

B. V. Vinogradov

Various methods of remote sensing may be used to study the /1*
vegetation, soil, and agricultural use of land: photographic methods,
television, infrared, spectrometric, multi-spectral, and microwave
methods. In view of the fact that a study of the vegetation and soil
cover requires primarily a resolution of 30-300 meters and three-
dimensional recording of surface structure details, at the present
time we are primarily using space photographs which provide the neces-
sary resolution and covering.

Visual space observations of vegetation, soil and agriculture are
of definite methodical interest. In the middle of June, 1970, during
the flight of the Soyuz-9, the cosmonaut, V.I. Sevast'yanov, performed
such observations in the region of the Sel'sko-Tsimlyanskiy site.
For example, he could distinguish the soils based on the composition
and phenological stages of agricultural development.

Photographs, from the Soyuz-9, obtained in 1971, and from "Salyut"
in 1971, in the original scales from 1:8 million to 1:2 million

*Numbers in the margin indicate pagination in the original foreign text.

with a resolution of 20-30 meters to 200-250 meters covered all of the main key sites (No. 1, 2) and a supplementary key site (No. 2).

Television pictures, from the artificial earth satellite "Meteor" were regularly obtained with a resolution of 1.25 - 2.5 kilometers, particularly on the supplementary polygon No. 2, Balkhashsk.

The resolution element of thermal and radiothermal measurements, from the artificial earth satellites, "Kosmos" and "Meteor", is too large to be used in our studies. Infrared photographs from the artificial earth satellite "Meteor", between 8-12 micrometers, have a resolution of 15-20 kilometers, and the ellipse in which radio- /2 brightness temperatures are recorded in the microwave range of 0.8, 3.5, and 8.5 centimeters, amounts to 30-50 kilometers. Nevertheless, radiation characteristics have a definite dependence on the composition and condition of the vegetation, the composition and moisture of the soils, and the degree to which the area is plowed. Thus, for example, based on the meridional profile, measurements of $T_B^{\circ K}$ on September 23 - 24, 1968 at Sal'skiy steppe with dry, low-humus plowed soil containing dry, natural vegetation and with harvest lands provided the highest radiobrightness temperatures.

A. Study of natural vegetation

The natural vegetation was studied by means of photographs of the key sites, which were obtained from the Soyuz-9 and "Salyut" spacecraft. A very large number of such studies were carried out on the Balkhashsk key site with cultivated hayfields, pasture land, and vegetation used for fuel purposes. These studies, were less pertinent for the Sal'skiy key site, where 40-90% of the area was plowed, and the remaining area was rough pasture and cattle land of low productivity.

Different problems were encountered in analyzing vegetation: small-scale cartography of vegetation, study of the structure of the vegetation, estimation of the productivity, condition, and development

of pasture land, determination of the composition and condition of forests and undergrowth, and calculation of the extent of phreatophytes for hydrogeological purposes.

The studies were performed by synchronous observations and aerial photographs of the vegetation and soil during spacecraft flights, by subsequent field calibration of the space photographs, and also by identification of contours of the large-scale thematic maps on the space photographs.

The studies revealed the possibilities for space photographs in revising and updating small-scale maps and surveys, average scale geobotanical maps, at least within the scales of 1:0 - 1:10 million. Maps based on space photographs show greater details of the contours, greater accuracy in defining the boundaries between contours, better agreement between the contours and those on other thematic maps in the same region, greater complexity of the map and better representation of the current condition of the vegetation.

/3

B. Study of the Soil Cover

The program for studying all of the key sites (Sel'sko-Tsymlyansk, Balkhashsk, and even Ult'yurtsk) included the soil cover. The soil research had several purposes: soil-geographic division into zones, small-scale cartography and survey, average-scale soil cartography, study of the soil cover, and determination of individual properties of the soil cover: salinity, mechanical composition, heterogeneity, determination of the soil use and the degree to which the soil is plowed, an estimate of the soil condition as well as extent of wind and water erosion of the soil.

The analysis of the space photographs indicated that it was very complex to interpret the soil from them. This was due to the great role played by indirect characteristics: of the agricultural vegetation-soil, relief, type of land use, and also characteristics controlling the seasonal, weather, and daily factors. Nevertheless, it

was found that space photographs may be successfully used for soil-geographic division into zones in a scale of 1:2 million and smaller, and for revising and updating average-scale soil maps with scales of 1:0 - 1:1 million. The studies show that zonal soils are not as readily identified from space photographs as are azonal soils. The main soil-producing factors are distinguished comparatively easily: those related to salinity, erosion, water saturation, influence of soil-producing rocks, geological structure, etc. Finally, diverse forms of the agricultural use of the soil and their anthropogenic modifications are quite successfully identified. /4

C. Study of the Agricultural Use of the Land

When using space photographs to study the land use, we find that the most promising direction lies in space geographical methods, since this enables us to consider simultaneously the anthropogenic action and the unfavorable changes in the agricultural landscape. A study of the agricultural use of the land was made at the Sal'skiy key sites, which are located in the corn regions of the Soviet Union.

Their study included the following: cartography of the soil areas, the type of soil used, the elements of territorial organization, the types of crop rotation, identification of the composition and condition of the agriculture, and determination of the composition and condition of other areas: land used for hay, forest, and undergrowth.

Field and laboratory research indicated that the boundaries of the fields, the elements of territorial organization, the forms of land use and other macrostructural elements may be determined with an accuracy approaching 100 per cent. The accuracy is somewhat worse for determining composition and conditions of agriculture. The types of agriculture may be satisfactorily identified: coarse grain (corn, panic grass), fine-grain (wheat, rye, oats, barley), perennial grasses, etc. The determination of the soil composition within the limits of agricultural types gives reliability values which are average, or even too low, similarly to those which were obtained in photographs from Apollo 9 in 1959. (Anuta., MacDonald, 1971). /5

D. Landscape Research

The composite studies of the natural environment and the study of types of agricultural areas were performed in two methodical aspects: (A) combined multi-faceted studies of key sites and (B) typological landscape studies. These studies are of great value for inter-related research and for the conquest of natural resources.

Composite, multi-faceted studies were performed by means of combined geological-geomorphological and soil-geobotanical research, carried out at the Sel'sko-Tsymlyansk and Balkhashsk key site. As a result, a series of successive thematic maps on similar scales were compiled for one and the same territory.

Typological landscape studies were carried out to establish and map the natural-territorial complexes with multi-faceted characteristics. As a result, small- and average-scale landscape maps were compiled, showing the type of terrain and the classes of natural landmarks.

Translated for National Aeronautics and Space Administration under contract No. NASw 2483, by SCITRAN, P.O. Box 5456, Santa Barbara, California, 93108